

# Literature Survey on Efficient Energy Management Using Green Cloud Computing

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**Abstract:** With advancement in technology, the cloud computing emerging as a trending topic has been a serious point of discussion for the previous couple of years. With enhancement in technologies more people are engaging themselves personally or professionally over the web. With the rapid demand for service-oriented computing in association with the expansion of cloud computing technologies, large-scale virtualized data centers are established throughout the world. With regards to technological advancements, the associated shortcomings like environmental footprint caused by them also become an affair of high significance. The demand in cloud has been increasing enormously which cause increase within the energy consumption of information centers, which results in different kinds of critical issues. These huge data centers consume power at an outsized scale that leads to a high operational cost. The large carbon footprint from the energy generators is another great issue to deal heating. It is essential to lower the speed of carbon emission and energy consumption the maximum amount as possible. In this paper, a survey has been provided on how efficiently energy must be managed supported Green Cloud Computing.

**Keywords:** Energy efficient, Cloud, Data center, Green Cloud.

## I. INTRODUCTION

Cloud computing may be a rapidly growing “Internet Based Computing” which provides the various users to host their data online using cloud services. Cloud computing is that the delivery of on-demand computing services from applications to storage and processing power. During a commonest way we will say that cloud computing refers to running workloads remotely over the web during a commercial provider’s data center. The standard definition [1] of Cloud Computing according to NIST (National Institute of Standards and Technology):

“Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.”

The key advantage of cloud computing is agility: the power to use abstracted compute, storage, and network resources to workloads as needed and tap into an abundance of prebuilt services. Cloud computing is extremely advantageous and trending thanks to its accessibility because it facilitates the access of resources, data, applications from any location worldwide with an online Connection and price saving as it offers businesses with scalable computing resources. Google Cloud Platform, Amazon Web Services, IBM Cloud, Oracle Cloud, Microsoft Azure, Adobe, VMware, Rackspace and Red Hat are number of distinguished cloud service providers and for using these services customers must pay as per their need [7]. In differently of explaining cloud computing is to clarify its development model which might be referred as computing methodology which basically involves resources.

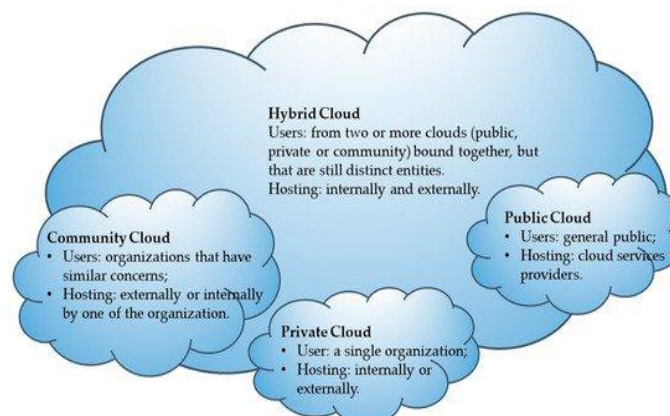


Fig 1: Deployment models of cloud

Following are the models of clouds as shown in Fig 1:

- A. Private Cloud: It's a cloud where cloud computing services offered the web or a non-public internal network to only select users rather than the final public. In this, cloud environments are solely dedicated to a specific user.
- B. Public Cloud: It is a cloud where cloud computing environment is obtainable to anyone over the net.
- C. Community Cloud: In this cloud, users of assorted organizations are allowed to use cloud environment with some shared concerns.
- D. Hybrid Cloud: It's a cloud computing environment which could be a combination of public and personal cloud.

Nowadays, service-oriented architectures are trending. This is the heart of cloud computing. Cloud computing mainly offers three types of services namely,

- A. IaaS- Infrastructure As A Service
- B. PaaS- Platform As A Service
- C. SaaS- Software As A Service

IaaS- Also called as HaaS i.e Hardware As A Service, which provides virtualized infrastructure for allocating virtualized computing resources to the users through internet.

PaaS- Platform As A Service, where third party provider distributes the software tools and hardware for the purchasers over internet on his own infrastructure.

SaaS- Software As A Service, where third party hosts applications and make them available to the user without need of putting in and applications on their personal data centers or on their own computers.

By using computers and other technologies in a effective way there could be increase within the consumption of resources, energy efficient peripherals and there will be reduction in the electronic waste. This may well be called as Green Computing. Green Computing is that the efficient use of resources and performance enhancements. In line with paper [6] there are two aspects of Green Computing:

- A) Software: To develop criteria in a way so that there might be a increase in program's efficiency, energy and storage.
- B) Hardware: There must be some technologies which can reduce the energy consumption and it might be economically efficient.

## **II. NEED OF GREEN COMPUTING**

The cloud computing is incredibly demanding now a days thanks to its easy accessibility and price saving nature to infrastructure and services on demand. Many companies are working with very huge data centers round the world. Thanks to the power of cloud computing, it provides power to computer to process because of which enormous amount of information is generated daily. Virtual datacenters require high energy usage for its operation. So as to cut back this applications of green cloud computing are used. By using Green Cloud Computing the energy consumption and carbon emission by cloud computing will be really a great environmental concern.

## **III. GREEN COMPUTING AND ITS APPLICATION**

Green Cloud Computing, also called as green information technology, may be a potential solution to aide within the solution of energy consumption. It is energy efficient solution which minimizes the impact of cloud computing on the environment. It is an answer that permits users to use all advantages of cloud storage in such a how that reduces their impact on the environment. In order to scale back the adverse effect on environment and to make cloud storage energy efficient there are several applications of Green IT which might be applied in Green Cloud Computing [6][7]:

1. Proper Management of Power
2. Energy –Efficient Resources
3. Design of Knowledge Centers
4. Virtualization of servers
5. Dynamic Voltage Frequency Scaling
6. To-Go Paperless

By using above applied methods to green Cloud Computing it reduces the earth's carbon footprint and results in an overall greener environment.

**IV. LITERATURE REVIEW**

Since, the environmental crisis is becoming worse day by day, more and more researchers and scientists are devoting their efforts so as to remain back the carbon emission and to realize the Green IT. Among all the efforts, the following studies should be stressed. A study associated with manage energy efficiently in using cloud storage was presented in 2018 by Xueying Yue paper titled “Analysis and Research on Green Cloud Computing” [1]. During this area, large quantities of knowledge are generated every single day. Therefore this data must be handled properly, which is not a straightforward task. This paper proposed a CLEER Model i.e. Cloud Energy and Emission Research which provides a way to reduce energy consumption in clouds in two aspects, they’re Estimated Server Comparison and Energy and Carbon Footprints Comparison. The adverse effects of cloud storage are minimized by using proposed model.

In 2019 Dr. Sujini Paul wrote a paper titled “Green Cloud Computing for Environmental Sustainability” [2] where she proposed the entire Green Cloud framework which considers the reduction of energy consumption of clouds. In a while this paper discuss about the working of Green Broker in selecting the Green Cloud Provider. The green offers have green services, pricing and time. The carbon emission directory manages all data pertaining to energy efficiency. Green Broker then calculates the carbon emission of all clouds providers. The data pertaining to energy efficiency of the cloud service is maintained in the carbon emission directory. And subsequently the Green Broker is responsible to calculate the carbon emission for all cloud providers giving the required cloud services in such a simplest way that there will be reduction in energy consumption in clouds.

In the year 2017 a paper was proposed by Dr. Seema Rawat titled “An Analytical Evaluation of challenges in Green Cloud Computing” where she had discuss about the cloud computing and also the architecture of the Green Cloud Computing. Presently this paper proposed the necessity and benefits of Green Cloud and also focuses on the methods to keep the cloud Green. Concluding ways to keep cloud Green this paper proposed several techniques like:

- A) DVFS- Dynamic Voltage Frequency Scheduling Technique
- B) Resource Allocation or Virtual Machine Migration Techniques
- C) Algorithmic Approaches

There is also discussion about the challenges in Green Cloud Computing to stay the adverse effects of cloud storage balanced and keep our cloud Green.

Mr. Manoj Kumar in the year 2018 wrote a paper [4] where he had discussed the varied elements of the clouds which contribute to the entire energy consumption. Cloud computing is a trending technology and it is becoming outsource to IT companies in terms of storage, computation and software like an ERP through large internet. At that time during this paper a scheduler is proposed which aims at minimizing per-job Total Energy Consumption by selecting the most effective resource allocation. Finally this paper discuss about the role of cloud users in achieving the goal to keep cloud green.

Riman Mondal in the year of 2019 wrote a paper [5] where she proposed a technique of live- migration enables dynamic virtual machine in order to reduce energy consumption along with the concept of clouds and its adverse effects on environment. With this proposed technique various VM selections are done for migration which plays a vital role in the domain of energy aware cloud computing. Later on, the concept of proper aware- VM policy selection is focused which determines the proper selection of Virtual Machines from overloaded hosts and also helps in performance evaluation.

**V. DISCUSSION**

The aim of this paper is to discuss the Green IT attributes which are contributing their efforts in order to achieve Green Cloud to stay back the harmful effect of cloud computing. There are several vendors as we all know which are involving in providing cloud services to the purchasers as per their need. All prominent cloud providers like Google, AWS, IBM are also contributing their efforts in becoming environmental friendly. Some of the vendors like AWS, Microsoft, Google have all committed to entirely rely on renewable power, so they have also started engaging themselves in building renewable sourced data centers. The Table 1 demonstrates the scores assigned by the environmental activist group Greenpeace in 2017 on clean energy usage for the major cloud vendors [6].

**TABLE I: GRADES GIVEN BY THE GREENPEACE IN 2017**

Sr. No.	Clean Energy Index	Natural Gas	Coal	Nuclear
AWS	17%	24%	30%	26%
Google	56%	14%	15%	10%
IBM	29%	29%	27%	15%
Microsoft	32%	23%	31%	10%

Greenpeace has considered several performance criteria for evaluation of different vendors like the vendors and reporting bodies while also taking media coverage and published reports into account.

## VI. CONCLUSION

The study surveyed some cloud computing concepts and its adverse effects on environment. To ponder this harmful effect of cloud several technologies are proposed. Green Cloud computing is one in all the simplest and effective thanks to reduce cloud storage effect on environment and it is efficient way to manage energy. As we all know that cloud computing is highly effective infrastructure to several businesses so to stay environment green Green IT is considered joined of the simplest possible solution to house it.

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